

RESEARCH ARTICLE | DECEMBER 28 2023

## Biodiversity of fish resources in transitional season II conditions—Sembilang National Park, Banyuasin Regency, South Sumatra Province **FREE**

Brenda Sellyndia; F. Fauziyah ✉; M. Melki; Fitri Agustriani; T. Zia Ulqodry; Ellis Nurjuliasti Ningsih; R. Rozirwan; Afan Absori



*AIP Conf. Proc.* 2913, 040003 (2023)

<https://doi.org/10.1063/5.0171611>



CrossMark



## APL Energy Latest Articles Online!

**Read Now**



# Biodiversity of Fish Resources in Transitional Season II Conditions–Sembilang National Park, Banyuasin Regency, South Sumatra Province

Brenda Sellyndia<sup>1)</sup>, F Fauziyah<sup>1, a)</sup>, M Melki<sup>1)</sup>, Fitri Agustriani<sup>1)</sup>, T Zia Ulqodry<sup>1)</sup>, Ellis Nurjuliasti Ningsih<sup>1)</sup>, R Rozirwan<sup>1)</sup>, Afan Absori<sup>2)</sup>

<sup>1)</sup>Marine Science Department, Faculty of Mathematics and Natural Science, Sriwijaya University, Palembang, Indonesia

<sup>2)</sup>Berbak Sembilang National Park Center, Banyuasin, Indonesia

<sup>a)</sup>Corresponding author: siti\_fauziyah@yahoo.com

**Abstract.** The traditional zone in Sembilang National Park is an area of marine and coastal ecosystems. One of the conservation and utilization potentials in this zone is the presence of fish resources. The presence of fish fluctuates with the seasons. One of the transition seasons II is the transition period from the east to the west season. The comprehension of biodiversity is an effort to maintain the sustainability of fish resources. This research aims to analyze the biodiversity of fish in transitional season II. The research was conducted in October 2020. The identification results obtained 8 orders, 20 families, 27 species. The composition of sea origin species is more (78.13%) than brackish (21.87%) and fresh (0.19%). The most dominating species are *Kurtus indicus* of marine origin and *Opisthapterus tardoore* of brackish origin. The category of a diversity index is moderate (1.05-2.45), the evenness index of the medium category, and the dominance index of the low category (0.01 – 0.37). It indicates the ecosystem of fish resources in Sembilang National Park in transitional season II is quite balanced with moderate ecological pressure.

**Key words:** Fish Biodiversity, Sembilang National Park, Fish, Transitional Season II

## INTRODUCTION

Mangrove ecosystems are discovered in coastal estuarine which is influenced by tides. It is reinforced [1] that the Sembilang National Park is the most extensive mangrove ecosystem on the east coast of South Sumatra Province. The wetland area of Banyuasin Regency consists of freshwater swamp forest which extends up to 35 km inland.

The society of Sembilang National Park depends on their life as fishermen and pond aquaculture [2]. Mangrove forest ecosystems in Sembilang National Park control a significant role as a source of nutrients to economic value fish are consumed by society and non-economics. The dominant marine fish are tongue sole (*Cynoglossus* sp), Dorab wolf-herring (*Chirocentrus dorab*), Panna croaker (*Panna microdon*). Meanwhile, the brackish origin fish are dominated by Gray eel-catfish (*Plotosus canius*), Sagor catfish (*Arius sagor*), and Spottail needlefish (*Tylosurus strongylurus*) [3]. The diversity of fish resources is affected by lots of factors, one of which is a seasonal factor. One of 4 seasons in Indonesia the transitional season II is a transition period from east to west season. Transitional Season II occurs from September to November [4].

The zonation in Sembilang National Park is divided into 6. One of them is the traditional zone which is an estuary and coastal area. One of the conservation and utilization potentials in this zone is the presence of fish resources [5]. For this reason, biodiversity is a venture to maintain the sustainability of fish resources in the conservation area is Sembilang National Park.

## MATERIALS AND METHODS

This research was conducted in October 2020 in Sembilang National Park, Banyuasin Regency, South Sumatra Province, and around (Figure 1). This research has obtained the SIMAKSI concession of Sembilang National Park management and accedes to the COVID-19 protocol with non-reactive Rapid Test results.

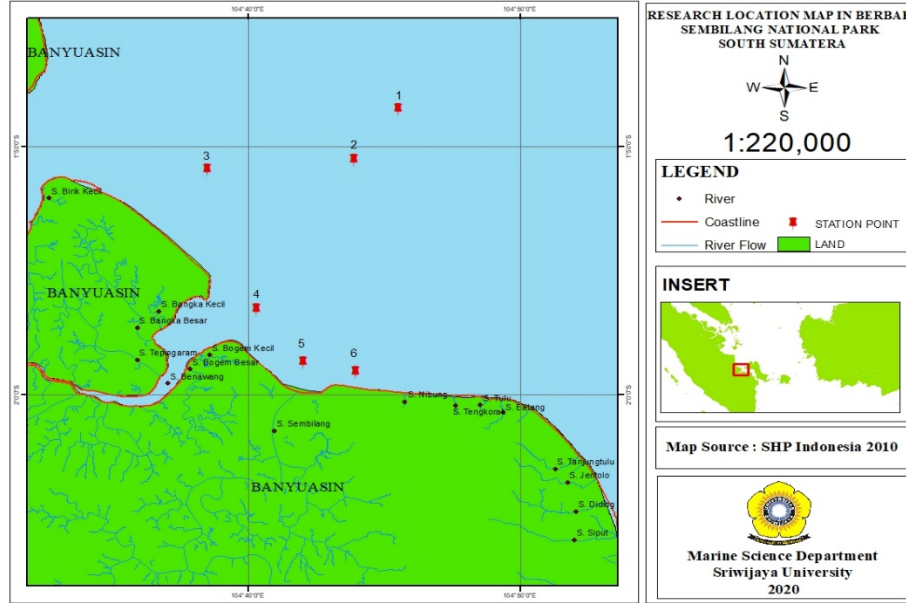


FIGURE 1. Research site in Sembilang National Park

The accumulation of primary data applies the method of fishing survey. The sampling location follows the fishing ground of local fishermen. For comparing the biodiversity of fish resources, the sampling was divided into two groups of fishing grounds (Figure 1), namely fishing grounds near the sea (stations 1-3) where sampling used drift gillnet (200 m length, 1.5 m high, 4-inch mesh size) and the fishing ground closed to mangrove area (station 4-6) where sampling used bottom gill net (350 m length, 1.5 m high, 3.5-inch mesh size). Primary data collection was conducted one-day trip for 6 days.

The fish samples found were identified by referring to the identification book to determine the taxonomy [6]. The environmental parameters were measured temperature, salinity, dissolved oxygen, and pH. The measurements were carried out in conjunction with sampling on each fishing survey station point as much as three times. The analysts are catch composition [7], diversity index ( $H'$ ) [8,9], even index ( $J'$ ) [8,10] and dominance index ( $D$ ) [11,12]. The formula for these indexes was as follows:

$$H' = \sum_{i=1}^S \left( \frac{n_i}{N} \right) \ln \left( \frac{n_i}{N} \right)$$

$$J' = \frac{H'}{\ln S}$$

$$D = \sum_{i=1}^S \left( \frac{n_i}{N} \right)^2$$

Where  $H'$ =Shannon-Weaner species diversity index;  $J'$ =Evennes index;  $D$ =Dominance index;  $S$ =the total number of species;  $N$ = total number of the individual;  $n_i$ =the number of specimens in each species.

## RESULT AND DISCUSSION

### Aquatic Environment Parameters

Environmental parameters extremely affect the life of aquatic organisms. Each biota has a different value tolerance based on the ecosystem characteristic. Table 1 exhibit the results of temperature measurements at 6 stations at about 28.3 - 29.7°C. Research [13] on September in Banyuasin coastal found temperatures around 29.6 – 31.1°C according to fish and crustaceans for these coastal areas. Research [14] in Sembilang National Park stated that the characteristic of temperature in mangrove estuary ranges about 25-30°C. According to the Decree of the Indonesian Ministry of Environment No. 51 of 2004, the optimal growth temperature for biota ranges from 28°-30°C.

**TABLE 1.** Aquatic environmental parameters in Sembilang National Park

Station	Temp (°C)	pH	DO (mg/L)	Salinity (ppt)
1	29.7	8.3	9.14	32
2	28.3	7.8	7.07	31
3	28,7	7,3	6,11	32
4	28,6	7,2	5,01	31
5	29,1	7,4	5,26	31
6	28,6	7,4	5,39	32
min	28.3	7.2	5.01	31.0
max	29.7	8.3	9.14	32.0
mean	28.8	7.6	6.33	31.5
σ	0.5	0.4	1.57	0.5

The measurements of pH at all stations ranged from 7.2 to 8.3. Research conducted [13,15] states that the pH range 7.79 – 8.34 and 7.1 – 8.5 indicates a normal value that supports the biota to survival. Based on the Decree of the Indonesian Ministry of Environment No. 51 of 2004, a proper value of pH for marine organisms survive about 7-8.5. Dissolved oxygen (DO) values at all stations ranged from 5.01-9.14 mg/L. The value of dissolved oxygen at the research site is in good condition because it complies with the quality standards of Decree State Minister of the Environment No. 51 of 2004 for the life of biota with a DO value > 5 mg/L. The results of salinity measurements in the research site range from 31 - 32 ppt and it can be categorized as a normal salinity. [16] stated that the salinity value in every station < 32 ppt was categorized as normal and affected by freshwater and river flow. Based on the measurements of environmental parameters ( temperature, pH, DO, and salinity), these parameters in Sembilang National Park were strongly supported for the fish resources growth.

### Fish Composition

The composition of fish species in the Traditional Zone of Sembilang National Park as thorough is shown in Table 2. The composition of fish is discovered amount 27 species, 8 orders, and 20 families with 536 individuals. In this research, marine, brackish and freshwater species were separated. There were 20 species of marine origin with 418 individuals (78%), 6 species of brackish origin with 117 individuals (21.8%), and 1 species of freshwater origin (0.2%). The dominant order of marine origin is Perciformes (252 individuals) followed by Clupeiformes (153 individuals). The dominant order of brackish origin is the order of Clupeiformes (93 individuals) and the order of freshwater origin has only one order, Synbranchiformes. The most dominating family in all research areas was Engraulidae and the dominant species was *Opisthopterus tardoore* (89 individuals). The composition of fish in the Banyuasin coastal estuary consists of brackish, freshwater, and marine origin, dominated by the families Engraulidae, Sciaenidae, Carangidae [17].

The most common marine species discovered was *Kurtus indicus* from the Kurtidae family as many as 107 individuals. The percentage of brackish origin species with the top of number individuals obtained was *Opisthopterus tardoore* from the Pristagasteridae family was 89 individuals. Simply one species of freshwater origin found specifically *Monopterus javanensis* from the family Synbranchidae.

**TABLE 2.** Composition of fish species in Sembilang National Park

No	Ordo/Family	Scientific Name	Common name	Station						Number of individuals
				1	2	3	4	5	6	
Marine										
	Clupeiformes									
1	Chirocentridae	<i>Chirocentrus nudus</i>	Dorrab wolf-herring		1				11	12
2	Engraulidae	<i>Coilia dussumieri</i>	Gold-spotted anchovy		63	1				64
3		<i>Setipinna taty</i>	Scaly hairfin anchovy	1	29	15				45
4		<i>Setipinna breviceps</i>	Horthead hairfin anchovy	1	4	3	9	6		23
5		<i>Setipinna tenuifilis</i>	Common hairfin anchovy		6					6
6		<i>Stelophorus commersoni</i>	Commerson anchovy		3					3
	Cypriniformes									
7	Cyprinidae	<i>Scimatorhynchos heterorhynchos</i>						3		3
	Eupercaria									
8	Nemipteridae	<i>Nemipterus nematophorus</i>	Doublewip threadfin bream	1						1
	Myliobatiformes									
9	Dasyatidae	<i>Pateobatis fai</i>	Pink whipray	1		1				2
	Perciformes									
10	Carangidae	<i>Parastromateus niger</i>	Black pomfret		8	2				10
11	Kurtidae	<i>Kurtus Indicus</i>	Indian forehead brooder	30		4			73	107
12	Polynemidae	<i>Eleutheronema tetradactylum</i>	Fourfinger threadfin						1	1
13	Sciaenidae	<i>Nibea soldado</i>	Soldier croaker		7	5	6	6	27	51
		<i>Panna microdon</i>	Panna croaker	1	35		5			41
14	Stormateidae	<i>Pampus argenteus</i>	Silver pomfret		9				25	34
15	Sphyraenidae	<i>Sphyraena barracuda</i>	Great barracuda					1		1
16	Trichiuridae	<i>Trichiurus lepturus</i>	Largerhead hairtail		4					4
17	Scombridae	<i>Scomberomorus guttatus</i>	IndoPacific king mackerel	2						2
18		<i>Rastrelliger kanugarta</i>	Indian mackerel	1						1
	Pleuronectiformes									
19	Cynoglossidae	<i>Cynoglossus lingua</i>	Long tongue sole	3	3			1		7
	Sub-Total			41	172	31	20	17	137	418
Brackish										
	Clupeiformes									
20	Engraulidae	<i>Thryssa hamiltonii</i>	Hamilton's thryssa	1	3					4
21	Pristigasteridae	<i>Opisthopterus tardoore</i>	Longfin shad						89	89
	Pleuronectiformes									
22	Paralichthyidae	<i>Pseudorhombus arsius</i>	Largetooth flounder	2	6					8
	Perciformes									

No	Ordo/Family	Scientific Name	Common name	Station						Number of individuals
				1	2	3	4	5	6	
Continued										
24	Leiognatidae	<i>Leiognatus equulus</i>	Common ponyfish	1						1
24	Serranidae	<i>Ephinephelus sexfasciatus</i>	Sixbar grouper	1						1
	Siluriformes									
25	Ariidae	<i>Hexanematchthys sagor</i>	Sagor sea catfish	3		7	4			14
	Sub Total			8	9	7	4	0	89	117
	Freshwater									
26	Synbranchiformes									
	Synbranchidae	<i>Monopterus javanensis</i>	Asian swamp eel		0		1			1
	Sub Total						1			1
	Total			49	181	38	25	17	226	536

The composition of fish species is discovered based on groups was group 1 (stations 1-3) which towards the sea (the distance of land 5-18 km) consisted of 22 species, 6 orders, 15 families, and 268 individuals. There were 17 species of marine origin with 244 individuals (91%), 5 species of brackish origin with 24 individuals (9%). The dominant species were *Coilia dussumieri* (24%) and *Setipinna taty* (17%) from the Engraulidae family. Group 2 (stations 4-6) around the mangrove ecosystem (the distance of mainland 1-2 km) consists of 22 species, 6 orders, and 12 families with 268 individuals total. There were 10 species of marine origin with 174 individuals (64.9%), 2 species of brackish origin with 93 individuals (34.7%), and 1 species of freshwater origin (0.4%). The dominating species were *Opisthopterus tardoore* (33%) from the family Pristigasteridae and *Kurtus Indicus* (27%) of the Kurtidae family. It compares 2 groups, the number of species and individuals were similar in both. It possibly occurs as their on a similar coastal site in Sembilang National Park. However, those are different dominating species among them. The first group is pelagic-neritic species, amphidromous and oceanodromous [18] and the second group is pelagic-neritic species, amphidromous and benthopelagic [18].

The research was conducted in Sembilang National Park in 2009 obtained 28 families with 42 species [3]. The economic fish is dominated by *Cynoglossus* sp, *Chirocentrus dorab*, *Panna microdon*, *Arius sagor*, and *Plotosus canius*. The results of this research obtained 20 families and 27 species and the most dominating were *Kurtus indicus*, *Coilia dussumieri*, *Opisthopterus tardoore*, *Setipinna taty*, *Panna microdon*, and *Nibea soldado*. The results indicate the number of families and species found was less than [3] under a similar condition in transition season II. It's possible as in [3] use a 'belat' fishing gear (set gillnet) which a narrower mesh size (1.4 inches) compared to this research using bottom gillnets and drift gillnets mesh sizes about (3.5 - 4 inches). The lack of found fish along the research was presumed as the main catches of the fishing gear were shrimps and crabs, but also the catches obtained were by-catch and discarded fish. According to Firdaus [19], ride into the October-February, big waves, strong currents in the presence of westerly winds, the mix of sea and fresh water to a muddy substrate, and these conditions are ideal for shrimp and crabs. According to [14], the catch of fish will get much more at the peak of June to August.

## Biodiversity of Fish Resources in transitional season II

The estuary is an aquatic area dominated by land so it shows a diversity of fish species. The biodiversity of fish resources in the traditional zone at Sembilang National Park is a venture to maintain the sustainability of fish resources. The values of diversity, evenness, and dominance index have differences at stations because lots of factors can affect them, such as physical-chemical parameters, substrates, seasons, migration, and food availability. The diversity index (H'), Evenness (J'), and dominance (D) and their categories are presented in Table 3.

**TABLE 3.** Diversity Index Analysis ( $H'$ ), Evenness Index ( $J'$ ), and Dominance Index ( $D$ ) in Sembilang National Park- South Sumatera.

Station	Diversity ( $H'$ )		Evenness ( $J'$ )		Dominance ( $D$ )	
	Value	Category	Value	Category	Value	Category
1	2,45	Moderate	0,83	High	0,10	Low
2	2,15	Moderate	0,40	Moderate	0,16	Low
3	1,60	Moderate	0,52	Moderate	0,22	Low
4	1,42	Moderate	0,26	Low	0,28	Low
5	1,70	Moderate	0,47	Moderate	0,24	Low
6	1,05	Moderate	0,36	Moderate	0,37	Low

Note: high ( $H' > 3$ ;  $J' > 0.6$ ;  $D > 0.7$ ); moderate ( $1 < H' < 3$ ;  $0.3 < J' < 0.6$ ;  $D < 0.6$ ); low ( $H' < 1$ ;  $J' < 0.3$ ;  $D < 0.5$ )

The Diversity Index is between 1.05-2.45. The highest value of the diversity index at station 1 is ( $H=2.45$ ) towards the sea and the lowest ( $H=1.05$ ) is at station 6 towards the mainland close to the mangrove ecosystem. Research conducted during November in Sembilang National Park [3] has a value diversity range of 1.71 to 2.40, meanwhile, in Banyuasin coastal during September [20] has an average value of diversity  $H' = 1.54$ . In the Belawan River, North Sumatra during October – December [21] has a diversity value ranging from 2.45 to 2.64. The entire value of the diversity index is in the range of  $1 < H' < 3$  with a moderate category.

Evenness Index between 0.26-0.83. The highest value of the evenness index is at station 1 ( $J' = 0.83$ ) towards the sea as a high category and the lowest ( $J' = 0.26$ ) at station 4 towards the mainland close to the mangrove ecosystem as a low category. There are other stations in the moderate category. According to [20], the average evenness index value is  $J' = 0.48$  in the moderate category. While the evenness index value between 0.70-0.82 [3], and between 0.81-0.88 [21]. Both evenness index values are in the range  $J' > 0.6$  with the high category.

Dominance index between 0.10-0.37. The highest value of the dominance index was at station 6 ( $D=0.37$ ) towards the mainland close to the mangrove ecosystem and the lowest ( $D=0.10$ ) is at station 1 towards the sea. The dominance index value in Sembilang National Park was between 0.14-0.16 [3], the average value of the dominance index in Banyuasin coastal was 0.38 [20], whereas in Belawan was between 0.04-0.06 [21]. The entire evenness index value in the range of  $D < 0.5$  was still in the low category.

Based on the results obtained, if it is observed furthermore in group 1 (Station 1-3), towards the sea and group 2 (Station 4-6) towards the mainland close to the mangrove ecosystem, there are slightly different characteristics even in the similar diversity and dominance index moderate and low category. Group 2 has a lower Diversity index and a higher Dominance index than group 1. The low diversity index in group 2 is due to human activities on land that have an ecological impact on the diversity of fish resources in this area.

Generally, the biodiversity of fish resources in the traditional zone of Sembilang National Park for 8 years (2012-2020) in transitional seasons II, has a similar category specifically the moderate and low categories of the Diversity and Dominance index. The category of biodiversity on the island of Sumatra in transitional season II has the same category. It indicates the condition of the fish resource ecosystem in Sembilang National Park in transitional season II is stable as it has moderate diversity ecological pressure, is evenly distributed and no species dominates.

## CONCLUSION

The composition of fish catches at 6 points research station found 20 species of marine origin and 6 species of brackish origin and 1 species of freshwater origin consisting of 8 orders, 20 families with a total number of 536 individuals and total weight are 23.08 kg. The moderate diversity index, medium evenness index, and low dominance index indicate the biodiversity fish resources condition of Sembilang National Park in the transitional season II was stable with maintained diversity, and species distribution was evenly distributed and none dominated.

## ACKNOWLEDGMENT

The authors would like to thank Banyuasin 2020 crews for their help and collaboration. We are very grateful to the reviewers who provided invaluable suggestions for this paper. And special thanks to Anggaran DIPA Badan Layanan Umum Universitas Sriwijaya Tahun Anggaran 2020 dan 2021 Sesuai dengan SK Rektor Nomor : 0687/UN9/SK.BUK.KP/2020 and 0010/UN9/SK.LP2M.PT/2021 thus this research has been achieved



## REFERENCES

- [1] M. Indica, T.Z. Ulqodry, and M. Hendri, Maspari J. **02**, 77–81 (2011).
- [2] P. Pardona, F. Agustriani, and Sarno, Maspari J. **8**, 1–6 (2016).
- [3] Fauziyah, T.Z. Ulqodry, F. Agustriani, and S. Simamora, J. Penelit. Sains **15**, 164–169 (2012).
- [4] Fauziyah, F. Agustriani, D. Melda Situmorang, and Y. Suteja, [E3S Web Conf.](#) **47**, 1–10 (2018).
- [5] B. Taman, N. Berbak, and D.A.N. Sembilang, *Rencana Pengelolaan Jangka Panjang Taman Nasional Sembilang Tahun 2020-2029* (Balai Taman Nasional Berbak Sembilang, Palembang, 2020).
- [6] K. V. Ulukyanan, E. HP. Melmambessy, and B. Lantang, [Musamus Fish. Mar. J.](#) **1**, 89–100 (2019).
- [7] W. Susaniati, A.F.P. Nelwan, and M. Kurnia, J. Akuatika **4**, 68–79 (2011).
- [8] I. Okyere, D.W. Aheto, and J. Aggrey-fynn, Pelagia Res. Libr. **1**, 178–188 (2014).
- [9] E.S. Wiyono, S.H. Wisudo, D.A. Soeboer, B. Pengelolaan, P. Tangkap, P.P. Kecil, and D. Kelautan, Mar. Fish. **5**, 91–99 (2014).
- [10] M. Ravanbakhsh, T. Amini, and S.M.N. Hosseini, J. Biodivers. Environ. Sci. **8**, 12–21 (2016).
- [11] D.K. Mondal, A. Kaviraj, and S. Saha, [J. Water Resour. Prot.](#) **2**, 85–92 (2010).
- [12] N. Davari, M.H. Jouri, and A. Ariapour, J. Rangel. Sci. **2**, 389–398 (2011).
- [13] Fauziyah, F. Agustriani, A.I.S. Purwiyanto, W.A.E. Putri, and Y. Suteja, [J. Phys. Conf. Ser.](#) **1282**, 012103 (2019).
- [14] S.A. Wardoyo and M. Iqbal, J. Ilmu-Ilmu Perikan. Clan Budid. Perair. **1**, 29–38 (2003).
- [15] A.D.R. Astrini, M. Yusuf, and A. Santoso, J. Mar. Res. **3**, 27–36 (2014).
- [16] S.I. Patty, J. Ilm. [Platax](#) **1**, 148–157 (2013).
- [17] Fauziyah, Nurhayati, S.M. Bernas, A. Putera, Y. Suteja, and F. Agustiani, [IOP Conf. Ser. Earth Environ. Sci.](#) **278**, 012025 (2019).
- [18] FishBase, World Wide Web Electron. Publ. [www.fishbase.org](http://www.fishbase.org) (2022).
- [19] M. Firdaus, Makara, Teknol. **14**, 22–28 (2010).
- [20] Fauziyah, F. Agustriani, W.A.E. Putri, A.I.S. Purwiyanto, and Y. Suteja, [AACL Bioflux](#) **11**, 1515–1524 (2018).
- [21] H.M. Manullang and Khairul, J. Ilmu Alam Dan Lingkung. **11**, 1–7 (2020).